

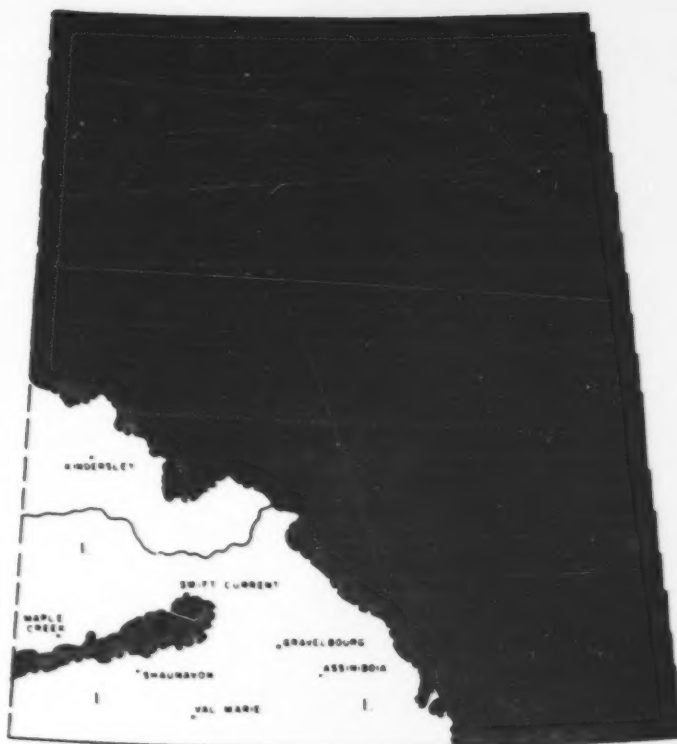


Saskatchewan
Agriculture

Soils & Crops
Branch

Forage Crop Recommendations

ISSN 0383-3356



Forage Crop — Soil Zones of Saskatchewan

1. Brown 2. Dark Brown 3. Black — Gray-Wooded

Contents

- Recommended Forage Crops and Varieties
- Legume Inoculation
- Seeding Perennial Forage Crops
- Annual Forage Crops
- Fertilizer Recommendations
- Pasture Systems
- Herbicide Recommendations
- Nitrate Poisoning
- References



NOTE: TITLES ON TABLES
(PGS. 14 & 15) ARE REVERSED.

Drawings courtesy of Agriculture Canada

Steps to Successful Seeding

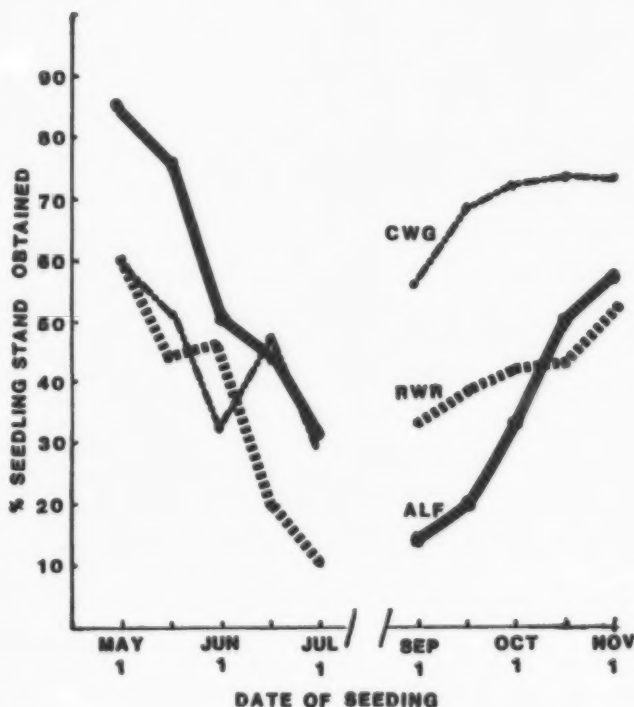
1. Careful preparation of land, equipment and seed is essential for successful forage seeding. Moisture is also a critical factor: establishment failures can occur during dry periods even with excellent seeding techniques.
2. Seed shallowly - for most forages, roughly 1/2 - 1 inch (1-3 cm) deep.
3. Seed into a firm seedbed. Clean, unworked stubble land is excellent. Fallow land should be worked shallowly, followed by harrowing and packing prior to seeding. Drills should not penetrate deeper than 1 inch (3 cm).
4. Choose a seeding implement that can deliver low seeding rates without bridging or plugging, and one that has good depth control. Discers are generally not acceptable.
5. If necessary, use herbicides to control winter annual weeds (see publication, Guide to Chemical Weed Control).
6. Use seeding rates in this Guide. As a starting point, set drill to deliver 1 bu/acre on the wheat scale. Ideal rate is 20-30 seeds per foot of row. Check seeder by running over a hard surface and counting seed. (For calculating custom seeding rates, use method outlined on page 5.)
7. Many grain drills are not designed to handle the low seeding rates required for forages. This can be overcome by using a grass seeder attachment or seeding through the fertilizer box. Small or light seed may be seeded more successfully by using one of the following carriers: a) two parts of low-N fertilizer (i.e. 11-55-0) with one part of seed by volume, except with inoculated legumes; or b) cracked grain, or c) horticultural vermiculite.
8. Wide-spaced or alternate-row seeding can be done by taping or covering the drill openings not required, followed by (your choice): a) seed legume through forage seed or fertilizer box and grass through the grain box after diluting as in step 7, or b) divide drill box into compartments using dividers.
9. Companion crops usually reduce subsequent yield of forage, depending on moisture availability. Low companion crop seeding rates (1/2 to 1/4 of normal) in cross-row or alternate-row seeding will minimize competition. Companion crops are best cut early for hay, leaving a tall (6-8 inch) stubble. (Seeding companion crops with forage in the brown soils reduces the chances of obtaining a good stand of forage.)
10. For pastures, deferring grazing until the year after establishment is advisable, especially in drier areas.

Seeding Dates

Date of seeding is very critical with forages. The graph below shows the stands obtained from different seeding dates at Swift Current. Early spring (May 1) and late fall (Nov. 1) seeding gave the best establishment. Seeding at any time between June 1 and Oct. 1 gave poorer results. In more moist areas, spring seeding may be delayed to obtain proper weed control.

If late fall seeding is chosen, seed as close to freeze-up as possible, so no germination occurs until spring. Some winter seed loss may occur; depending on the severity of conditions (exposed fields, spring flooding, etc.) the recommended seeding rates on page 2 can be increased. Do not seed sweetclover in the fall as it may winterkill.

Effect of Seeding Date on Final Stand Obtained of Alfalfa, Crested Wheatgrass, and Russian Wildrye (Swift Current)



— redrawn from Kilcher, 1961

Recommended Perennial Forage Crops and Seeding Rates for Various Soil Zones

Soil Zone (see map on cover)	Crops	Row Spacing Inches cm	Approximate Seeding Rate lb./acre or kg/ha	
1. Brown.....	Hay Crops (seed grass and legume in alternate rows)			
	Crested wheatgrass & alfalfa	18-24 45-60	3 + 1	
	Intermediate wheatgrass & alfalfa	24-36 60-90	4 + 1	
	Alfalfa	18-24 45-60	4	
	Sweetclover	6 15	8	
	Pastures (cross-seed grass & legume)			
	Altai wild ryegrass & alfalfa	18-24 45-60	6 + 1	
	Crested wheatgrass & alfalfa	18-24 45-60	2 + 1	
	Russian wild ryegrass & alfalfa	18-24 45-60	3 + 1	
	Intermediate wheatgrass & alfalfa	18-24 45-60	6 + 1	
	2. Dark Brown...	Hay Crops (alternate rows)		
Bromegrass & alfalfa		12-18 30-45	6 + 2	
Crested wheatgrass & alfalfa		12-18 30-45	5 + 2	
Intermediate wheatgrass & alfalfa		12-18 30-45	6 + 2	
Alfalfa		12-18 30-45	6	
Sweetclover		6 15	8	
Pastures (cross-seeded if possible)				
Altai wild ryegrass & alfalfa		24 60	8 + 1	
Bromegrass & alfalfa		12-18 30-45	6 + 1	
Crested wheatgrass & alfalfa		24 60	4 + 1	
Intermediate wheatgrass & alfalfa		12-18 30-45	8 + 1	
Russian wild ryegrass & alfalfa		24 60	4 + 1	
Alfalfa (Caution — risk of bloat)		12-18 30-45	6	
3. Black and Grey-wooded		Hay Crops		
		Bromegrass & alfalfa	12 30	8 + 2
	Crested wheatgrass & alfalfa	12 30	7 + 3	
	Intermediate wheatgrass & alfalfa	12 30	11 + 3	
	Alfalfa	12 30	6	
	Sweetclover	6 15	8	
	Pastures			
	Bromegrass & alfalfa	12 30	8 + 1	
	Crested wheatgrass & alfalfa	12 30	7 + 2	
	Intermediate wheatgrass & alfalfa	12 30	11 + 2	
	Meadow bromegrass & alfalfa	12 30	8 + 1	
	Meadow bromegrass	12 30	10	
	Russian wild ryegrass	12 30	8	
	Sainfoin (non-bloating)	12 30	30	
	Birdsfoot trefoil (non-bloating)	6 15	4	
Irrigation.....	Hay Crops			
	Bromegrass & alfalfa	6 15	8 + 3	
	Intermediate wheatgrass & alfalfa	3 15	11 + 3	
	Alfalfa	6 15	8	
	Pastures			
	Meadow bromegrass & alfalfa	6 15	10 + 3	
	Bromegrass & alfalfa	6 15	8 + 3	
	Intermediate wheatgrass & alfalfa	6 15	11 + 3	
	Kentucky bluegrass & alfalfa	6 15	2 + 3	
	Meadow Bromegrass	6 15	10	
	Orchardgrass	6 15	10	
	Irrigated Pasture Note: Other mixtures of the above species may be developed using information on pg. 16.			

Recommended Varieties of Perennial Grasses

Grass	Varieties	Soil Zones	Comments
Bromegrass	Signal	1,2,3, Irr.	North/South type: high seed yield Northern Type Southern type with leaf spot resistance U.S. variety with satisfactory hay yield.
	Carlton	1,2,3, Irr.	
	Magna	1,2,3, Irr.	
	Baylor	1,2,3, Irr.	
Crested Wheatgrass	Fairway	2,3, Irr.	Used mainly for roadside seeding 5% higher yield than Fairway Does not persist in zone 3, Irr. Does not persist in zone 3, Irr.
	Parkway	2,3, Irr.	
	Nordan	1,2	
	Summit	1,2	
Russian Wild Ryegrass	Swift	1,2,3	Has most seeding vigor Good seed & forage yield Resistant to seed shattering
	Mayak	1,2,3	
	Cabree	1,2,3	
Intermediate Wheatgrass	Chief	1,2,3, Irr.	Higher yield than Greenleaf More drought tolerance & higher seed yield than Chief
	Clarke	1,2,3, Irr.	
	Greenleaf	1,2,3, Irr.	
Altai Wild Ryegrass	Prairieland	1,2,3	Saline tolerant; requires extra care in seeding year. Retains nutritive value in fall.
Slender Wheatgrass	Revenue	1,2,3	Quick to establish and saline tolerant; short-lived.
Tall Wheatgrass	Orbit	1,2,3	Saline tolerant; may become coarse
Meadow Bromegrass	Fleet	3, Irr.	More rapid regrowth than smooth bromegrass; good for pastures.
	Paddock	3, Irr.	
	Regar	3, Irr.	
Reed Canarygrass	Castor	1,2,3	Flood tolerant; high alkaloid Flood tolerant; Low alkaloid Flood tolerant; Low alkaloid
	Vantage	1,2,3	
	Venture	1,2,3	
Streambank Wheatgrass	Sodar	1,2,3	Yards, waterways, airstrips, etc.
Timothy	Climax, Champ, Basho	3	Grown mainly for seed production
Creeping Red Fescue	Boreal	Irr.	
Kentucky Bluegrass	Troy	Irr.	Low-growing pasture grass
Orchardgrass	Kay	Irr.	Good producer; not completely winterhardy in southern Sask.

Recommended Varieties of Perennial Legumes

Legume	Varieties	Soil Zones	Comments
Alfalfa	Heinrichs	1,2,3	(See Table Page 6)
	*Drylander	1,2,3	
	Rambler	1,2,3	
	Rangelander	1,2,3	
	Roamer	1,2,3, Irr.	
	Beaver	2,3, Irr.	
	Anchor	2,3, Irr.	
	Vernal	2,3, Irr.	
	Algonquin	3, Irr.	
	Apica	3, Irr.	
	Dekalb 120	3, Irr.	
	Barrier	Irr.	
Sweetclover	Norgold	1,2,3	Yellow flower, low coumarin
	Yukon	1,2,3	Yellow flower
Red Clover	Altaswede	3	Grown for seed, forage & plowdown
	Norlac	3	Grown for seed, forage & plowdown
Alsike Clover	Aurora	3	Grown for seed, forage & plowdown
	Dawn	3	Grown for seed, forage & plowdown
Sainfoin	Melrose, Nova	2,3	Non-bloating; may be short-lived.
Birdsfoot Trefoil	Cree	3	Non-bloating & higher seed yield than Leo
	Leo	3	Non-bloating

*Varieties that have been superseded for general use by new varieties and may be deleted in the future.

Grass - Legume Combinations

Generally, straight alfalfa will produce the highest yield of digestible nutrients of any perennial forage crop. However, grass-legume combinations are very useful in pastures because of:

- * less bloat potential in mixed pasture than in straight legume pasture.
- * mixtures provide a more uniform supply of forage throughout the growing season.
- * more uniform stand over entire pasture.
- * productive life of pasture is extended.

Brome-alfalfa is a popular grass-legume mixture. In the higher rainfall areas of the Province, brome becomes very aggressive. To maintain a good grass-legume balance in these areas, recommended seeding rates on page () can be adjusted to increase the alfalfa and decrease the brome component.

Alfalfa Variety Characteristics

Variety	Rooting Patterns	Cold Tolerance or Persistence	Recovery After Cutting	Reaction to Bacterial Wilt	Use
Rambler	Creeping	Very good	Slow	Mod. Resistance	Hay or Pasture
Roamer	Creeping	Very good	Slow	Resistant	Hay or Pasture
Heinrichs	Creeping	Excellent	Slow	Resistant	Hay or Pasture
Drylander	Strongly Creeping	Very good	Slow	Resistant	Hay or Pasture
Rangelander	Very Strongly Creeping	Very good	Slow	Susceptible	Pasture
Beaver	Tap	Good	Medium	Resistant	Hay
Algonquin	Tap	Good	Medium	Resistant	Hay
Vernal	Tap	Medium	Medium	Resistant	Hay
Anchor	Tap	Medium	Rapid	Resistant	Hay
Apica	Tap	Medium	Rapid	Resistant	Hay
Dekalb 120	Tap	Medium	Medium	Resistant	Hay
Barrier*	Tap	Medium	Rapid	Resistant	Irr. Hay

*Resistant to Verticillium Wilt

SOW RECOMMENDED VARIETIES

CERTIFIED SEED
SEMENCE CERTIFIEE

KIND ESPECE

VARIETY VARIETE

GRADE CATEGORIE



CANADA

CERTIFIED

N^o

CROP CERT N^o - N^o DU CERT DE RECOLTE
SEED CERT N^o LOT N^o - N^o DU CERT DE SEMENCE OU N^o DE LOT

MEMBER OF ASSOCIATION OF SEED PRODUCERS
MEMBRE DE L'ASSOCIATION DES PRODUCTEURS DE SEMENCES

986-32 (5-78)
PS 100

Crop Certificate Number

This number is assigned by the Association.

The first two digits represent the year in which the crop was produced.

The third to the ninth digits inclusive represent the identification number of the grower who produced the seed.

The tenth digit represents the code for the generation or class issued to the crop which produced the seed.

The eleventh digit represents the number of different certificates of the same status issued to the grower.

Seed Certificate Number

This number is assigned by Agriculture Canada for each lot of seed tagged by a Seed Inspector. There is a different number for each lot of seed.

Inoculation of Legumes

Inoculation is the addition of effective *Rhizobium* bacteria to legume seed prior to planting. After germination, the bacteria form nodules on the roots and begin taking nitrogen gas from the soil air. They convert the gas to nitrate and give it to the plant. Well nodulated forage legumes can grow vigorously without the need for commercial nitrogen fertilizer.

Need for Inoculation

Many Saskatchewan soils lack sufficient numbers of specific rhizobia needed for rapid growth and high yields of forage legumes. Inoculation corrects these deficiencies by sticking thousands of highly effective N-fixing bacteria to each seed just before planting. The cost of inoculant is generally very low and the potential benefits in forage yields and quality are substantial.

Each legume or group of legumes requires a unique species of *Rhizobium* to form nodules and fix nitrogen. The commercial inoculants available are prepared for specific legumes. Make sure you get the right one for your crop.

Methods of Inoculation

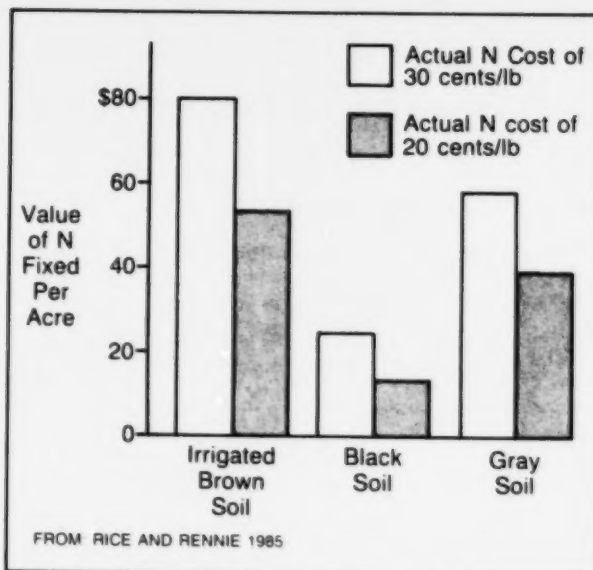
Inoculant is a dry powder that is mixed with the seed just prior to planting. In order to be effective, it must be "glued" to the seed, so a sticker solution is used to bind the two together. Sticking agents like dilute sugar water, molasses, soda pop, etc., are used, but research has shown that a solution of ordinary powdered skim milk is very effective.

Precise amounts of sticker are not important. Just mix the skim milk according to package directions (do not use hot water). Dribble (or spray) the milk onto the seed, wetting the surface of each seed, and let the excess milk drain off. Turning the seed during this operation will ensure complete wetting.

Once the seed is wetted, add the inoculant. Follow the manufacturer's instructions for proper amounts. If you plan to broadcast seed, or if seeding conditions are not ideal, increase the rate of inoculant. (Many growers routinely double the recommended rate of inoculant.) Stir the seed thoroughly, then proceed with seeding as quickly as possible.

Small batches of wetted seed can be inoculated manually by mixing the seed in a large container or on a polyethylene sheet. For larger amounts of seed, cement mixers or ice augers can be used for mixing.

Estimate on annual value of N fixed by a pure alfalfa stand on three different soil types using two different N prices.



Pre-inoculated Seed

Recently, commercially pre-inoculated alfalfa seed has come on to the market. Some problems with inoculant viability have been encountered with this product, but the technology is improving. Pre-inoculated seed may suffer drastic losses of inoculant viability after just a few weeks of springtime storage conditions. The Agriculture Canada Research Station in Swift Current maintains a regular testing program for all inoculant products.

Guide to Successful Nodulation

- Inoculate all legume seed with the right type of rhizobia.
- Use a sticker.
- Store inoculant in a cool dry place until use.
- Do not expose to direct sunlight.
- Inoculate seed just before seeding.
- Do not mix fertilizer with inoculated seed.
- Sow inoculated seed in a moist seedbed.
- Use higher rates of inoculant for adverse conditions.

Annual Crops for Forage

Annuals can provide good forage value and are particularly useful in times of feed or pasture shortage. However, long-term economics suggest the bulk of forage needs should be met with perennials, using annuals only for specialized or shortage situations.

The traditional annual forages and corn, which does well in the warmer parts of the Province, are listed below. Some experimental and minor use annuals are sorghum-sudangrass, millet, and kochia (a biennial managed as an annual).

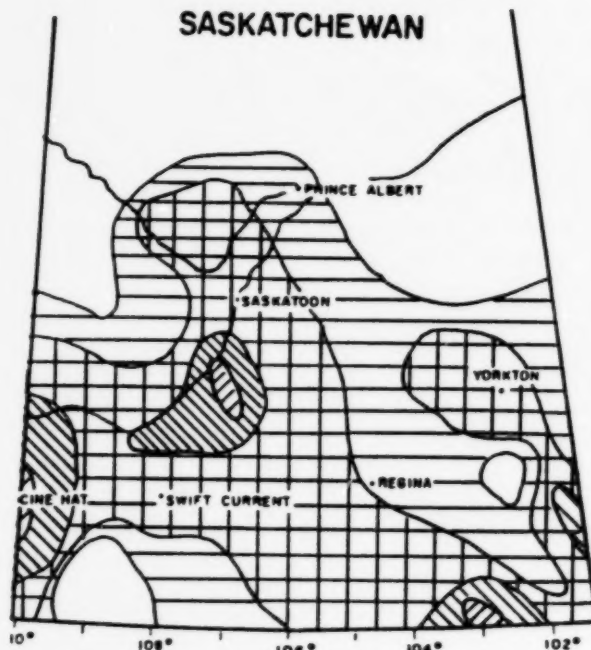
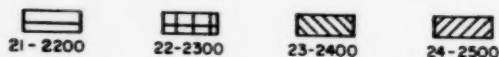
Annuals can be used for pasture, and fit well into complementary grazing systems (see page 12). The choice of crop depends on the time additional pasture is required: fall rye sown in late August to early September will provide early grazing the next spring, and oats, barley or wheat sown in the spring is ready for pasturing about seven weeks after planting. Spring-seeded Fall rye or Winter wheat will not go to seed, and provides abundant leaf growth for mid and late-season grazing.

High stocking rates (two cow/calf pairs or three steers per acre) plus rotational grazing will ensure good annual pasture productivity.

Annual Crop Varieties

		Soil Zones (see cover)
Oats	any recommended variety	1,2,3,Irr.
Wheat	any recommended variety	1,2
Fall rye	any recommended variety	1,2,3
Barley	Bonanza or any smooth awn variety	1,2,3,Irr.
Fababeans	any recommended variety	3,Irr.

Average Number of Corn Heat Units Received



Corn for Silage - Recommended Varieties

Variety recommendations are based on climatic heat units. See map below to determine heat unit rating for your area.

Heat Unit Rating	Brand and Hybrid Name	Days to Silking	Percentage of Stalk Breakage	Percentage of Plant Moisture	Silage Yield Tonnes/ha (Dry)
BELOW					
2300	Dekalb DK246	90	17.0	63.6	7.6
Heat Units	PAG SX104	87	15.3	64.6	8.9
	PIONEER 3994	84	15.5	64.9	7.9
	PIONEER 3995	82	34.8	63.8	8.2
	PIONEER 3996	87	8.5	63.8	8.2
ABOVE					
2300	Dekalb DK24	92	10.1	66.9	8.7
	Dekalb T778	95	19.9	65.4	8.9
	PAG SX95	91	14.1	64.5	8.7
	PIONEER 3953	92	NA	65.6	9.4
	PIONEER 3969	88	22.5	65.4	9.0

Treat seed with a recommended dual-purpose fungicide.

General Fertilizer Recommendations:

The following are general guidelines which may be used to plan fertilizer programs in the absence of a soil test. The suggested rate reflects the long term experience of the Saskatchewan Soil Test Lab. Large variations in nutrient contents can occur between fields. Accurate estimates can only be obtained with a soil test.

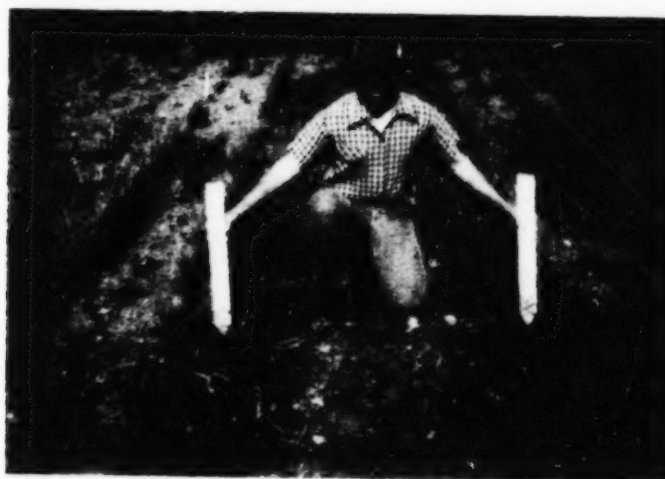
These suggested rates for nitrogen are defined for normal soil moisture conditions.

Phosphorous moves very slowly in soil, so for best results, it should be pre-incorporated.

Rates for potash and sulphur are for coarse textured well drained soils in the more humid regions of the province. On other soils these nutrients should only be applied on the basis of a valid soil test.

It is advisable to use some sulphur on Gray Wooded soils particularly when seeding legumes.

Crop	Soil Zone	Nitrogen kg/ha (lb/ac) Actual N	Phosphate kg/ha (lb/ac) Actual P_2O_5	Potash Gray Black and Gray Wooded Sandy Soils kg/ha (lb/ac) Actual K_2O	Sulphur Gray Wooded Soils kg/ha (lb/ac) Actual S
Cultivated grasses and Grass — legume mixtures	— Brown and Dark Brown	35-80 (30-70)	0-20 (0-20)		
	— Black and Gray	35-100 (30-90)	0-45 (0-40)	0-40 (0-35)	0-20 (0-20)
	— Irrigation	90-175 (80-160)	0-45 (0-40)		
Legumes	— Brown and Dark Brown		20-35 (20-30)		
	— Black, Gray	Inoculate Seed	35-45 (30-40)	0-40 (0-35)	0-30 (0-25)
	— Irrigation (all zones)		45-65 (40-60)		



Adapted forages can increase production on salt-affected land.

Methods of Fertilizer Application and Placement:

Nitrogen N	Phosphorus P ₂ O ₅	Potash K ₂ O	Sulphur S
New Seeding: Broadcast and incorporate or deepband prior to seeding. Inoculate legume seed. Established Stands: Broadcast fertilizer Ammonium nitrate (34-0-0) in fall or spring Urea (46-0-0) and ammonium Sulphate (21-0-0) last week in Oct. or very early spring. Adding N may reduce proportion of legume in stand. For seed production apply ammonium nitrate (34-0-0) immediately after harvest.	New Seeding: If seed row spacing is 15 cm (6 in.) up to 15 kg P ₂ O ₅ /ha (15 lb/ac) may be seed placed. At higher rates, broadcast and incorporate or deep band or sideband. Sidebanding is best if row spacing is 30 cm (12 in) or more. Established Stands: Broadcast in fall or early spring for pasture or hay. Broadcast after harvest for seed production.	New Seeding: Broadcast and incorporate or sideband. Established Stands: Broadcast at same time as nitrogen.	New Seeding: Broadcast and incorporate or deep band or sideband. Established Stands: Broadcast at same time as nitrogen.
Legumes New Seeding: Inoculate seed. If recommended by soil test, broadcast and incorporate or deep band or sideband N.	New Seeding: Up to 15 kg P ₂ O ₅ /ha (15 lb/ac) May be seed placed if row spacing is 15 cm (6 in). At higher rates or wider seed row spacings, broadcast and incorporate or deep band prior to seeding or sideband. Established Stands: Broadcast in fall or early spring.	New Seeding: Sideband or broadcast and incorporate. Established Stands: Broadcast at same time as phosphorus.	New Seeding: Sideband, broadcast or deep band. Established Stands: Broadcast at same time as phosphorus.

For more complete information about fertilizers and fertilization practices see the bulletin, "Saskatchewan Fertilizer Practices".

A. Source of Nitrogen

Established grass stands should be fertilized with granular fertilizers. Experiments have shown granular fertilizers are the most effective nitrogen sources for grasses. Spraying nitrogen solutions, particularly those containing urea, on to forage is unsatisfactory and not recommended. Response to nitrogen fertilizers depends upon time of application, amount applied, type of nitrogen fertilizer, age of stand, species of grass, number of cuts taken and climatic conditions. In Saskatchewan (urea and dry fertilizers containing urea) is usually less effective than ammonium nitrate. The relative effectiveness of the various fertilizers when broadcast urea is given a value of 100 are:

	Relative Value
Ammonium nitrate broadcast	110 - 120
Urea broadcast	100

B. Time of Application

1. Grass for Hay or Pasture. Grass for hay and pasture should be fertilized in early spring (as soon as fields are sufficiently dry in April or early May), or late fall. Fertilizer should not be applied to frozen soils that are subject to water run-off. The average relative values

of time of application when early spring broadcast nitrogen is given a value of 100 are:

Time	Relative Value
Spring	100
Fall	80

Split application of nitrogen during the growing season as compared to a single large application in early spring results in more efficient use of the applied nitrogen. Splitting a fertilizer application will not increase forage yields above single application levels, but the forage protein content is improved with split application. Split applications of less than 45 lb N/ac (50 kg/ha) total are not recommended.

2. Grass for Seed Production Timing of nitrogen fertilizer application for grass-seed production is very important and varies with species. The time of application of nitrogen fertilizer for various grass species is as follows:

Meadow Fescue	October of April
Timothy	October of April
Bromegrass	Right after harvest
Russian Wild Ryegrass	Right after harvest
Wheat grasses	Right after harvest

HERBICIDES FOR USE IN FORAGE CROPS

For more information on herbicides see "Chemical weed control in cereal, oilseed, pulse and forage crops".

Herbicide	Seedling Grass											Seedling Legume				Est. Grass	Established Legume				Cover Crop											
	Bromegrass	Creeping Red Fescue	Crested Wheatgrass	Inter. Wheatgrass	Kentucky Bluegrass	Meadow Fescue	Orchardgrass	Reed Canarygrass	Russian Wild Ryegrass	Slender Wheatgrass	Timothy	Alfalfa	Alsike Clover	Red Clover	Sweetclover		White Clover	Grasses	Bromegrass	Russian Wild Ryegrass	Alfalfa	Alsike Clover	Birdfoot Trefoil	Red Clover	Sweetclover	Barley	Flax	Oats	Wheat			
Consult the label for final detailed instructions												X ¹	X ²	X ²	X ²	X ²																
												X ¹	X ²	X ²	X ²	X ²																
												X ²	X ²	X ²	X ²	X ²																
												X																				
													X	X	X	X	X															
Asulox F												X ¹	X ²	X ²	X ²	X ²											X					
Avadex BW												X ²	X ²	X ²	X ²	X ²										X	X					
Avenge 200-C	X ²	X ²	X ²		X ²	X ²	X ²	X ²	X ²			X ²	X ²	X ²	X ²	X ²										X	X					
Basapon/Dowpon												X																				
Buctril-M	X ⁴	X ⁴	X ⁴		X ⁴	X ⁴	X ⁴	X ⁴	X ⁴	X ⁴	X ⁴		X	X	X	X										X	X	X				
Carbyne/Wypout	X	X ⁴	X ⁴						X	X ⁴	X ⁴	X	X	X	X	X										X	X					
Cabutox Embutox E/Buynox 400												X	X	X	X	X										X	X	X				
Eptam 8E												X																				
Fusilade													X ⁹		X ⁹																	
Hoe-Grass	X ⁵	X ⁵	X ⁵						X ⁵			X ⁵	X ⁵	X ⁵	X ⁵									X ⁹			X	X				
Kerb 50W																																
Mataven/Mataven L	X ⁴	X ⁴	X ⁴		X ⁴				X ⁴			X ⁴		X ⁴																		
MCPA	X	X	X						X																							
Pardner	X ⁴	X ⁴	X ⁴		X ⁴	X ⁴	X ⁴	X ⁴	X ⁴	X ⁴	X ⁴															X	X	X	X			
Princep Nine-T																																
Sinbar																																
Torch DS	X ⁴	X ⁴	X ⁴		X ⁴	X ⁴	X ⁴	X ⁴	X ⁴	X ⁴	X ⁴																					
Tropotox Plus																																
2,4-D	X ⁷	X ⁷	X ⁷	X ⁷					X ⁷																		X	X				

X- Product is recommended for the crop.

- For seed production only.
- Do not graze or feed during the year of establishment. Use only when forage seedlings are underseeded in crops for which herbicide is registered.
- Neepawa, Glenlea, Chester, Selkirk, Macoun, Canuck, Benito, Columbus, Leader, Katepwa, HY320.
- For seed production only, only in year of establishment.
- Use in year of establishment only. Do not use Forage For Feed.
- Pure stand only. Low rates of Kerb 50W may be used on mixed stands.
- Use 2,4-D amine only.
- For Forage use only.
- Do not harvest or graze during the year of treatment.

Perennial Forage Crops for Saline Soils, Flooded Areas and Peat (6 inch row spacings)

Salinity Rating *	Crop or Mixture	Approximate Seeding Rate for Hay or Pasture lb/acre or kg/ha
Soils with Minor Spring Flooding (up to 2 Weeks)		
Slight to Moderate (2-6 mmhos.)	Bromegrass + Russian wild ryegrass + alfalfa (creeping rooted)	4 + 4 + 4
	Bromegrass + slender wheatgrass + alfalfa (creeping rooted)	4 + 4 + 4
	Russian wild ryegrass + alfalfa	6 + 3
	Altai wild ryegrass + alfalfa	10 + 3
	Crested wheatgrass + alfalfa	7 + 3
	Altai wild ryegrass	11
	Slender wheatgrass + sweetclover (Short-term stands and not over 1 week flooding)	8 + 6
Severe (6-15 mmhos.)	Bromegrass + Russian wild ryegrass + slender wheatgrass	4 + 4 + 4
	Crested wheatgrass + Altai wild ryegrass + tall wheatgrass + alfalfa	4 + 4 + 4 + 2
	Altai wild ryegrass + alfalfa	10 + 3
	Tall wheatgrass (moist districts or seepage areas)	12
Spring Flooded (2-5 Weeks)		
Little or none (up to 2 mmhos.)	Reed canarygrass + bromegrass	4 + 6
	Reed canarygrass + timothy	4 + 4
	Timothy + bromegrass	4 + 6
	Altai wild ryegrass + alfalfa (2-3 weeks maximum flooding)	10 + 3
	Altai wild ryegrass	11
Slight to moderate (2-6 mmhos.)	Reed canarygrass + bromegrass	4 + 6
	Reed canarygrass + bromegrass + slender wheatgrass	4 + 6 + 6
	Altai wild ryegrass + alfalfa	10 + 3
	Altai wild ryegrass	11
Severe (6-15 mmhos.)	Altai wild ryegrass + alfalfa	10 + 3
	Slender wheatgrass	8
	Altai wild ryegrass	11
	Tall wheatgrass	12
Spring Flooded (5-8 Weeks)		
Little or none (up to 2 mmhos.)	Reed canarygrass	5
	Reed canarygrass + timothy + slender wheatgrass	3 + 3 + 6
Slight to moderate (2-6 mmhos.)	Reed canarygrass + slender wheatgrass	4 + 6
	Tall Wheatgrass	12
Peat, Poorly Drained Soils		
Slight (0-2 mmhos.)	Timothy + alsike clover	5 + 2
	Timothy + bromegrass + slender wheatgrass + alsike	3 + 5 + 5 + 2
	Timothy + bromegrass + alsike	3 + 6 + 2
	Reed canarygrass + timothy	4 + 3

*Ratings for salt content in millimhos per centimeter conductivity. Salt content reading can only be determined by obtaining a soil test from the Saskatchewan Soil Testing lab in Saskatoon.

Seeding Forages in Saline Seep Areas

Saline patches that appear in grain fields will steadily enlarge if annual cropping continues. Converting this land to forages is much more successful if done while the affected land still supports barley crop production.

Late fall seeding of saline areas is best, since early spring snowmelt temporarily decreases salinity concentrations.

Seeding mixtures of two, three or even four varieties of grasses and legumes is recommended. Non-saline tolerant species (alfalfa, crested wheatgrass) should be included in salinity mixtures so they can establish around seep edges and in pockets of better soil.

Nearby water recharge areas should be identified and seeded to taprooted alfalfa.

Complementary Grazing: More Pasture for More Months

Forage species differ greatly in total production and periods of peak growth, as shown in the table below.

Native prairie grasses grow slowly in the spring and are relatively low yielders. They give the best yields when grazing is deferred until mid-June. Native pasture can be easily damaged by grazing too early.

Crested wheatgrass starts growth early in spring and grows very rapidly in May and June. Bromegrass and alfalfa growth is greatest in June and July. Russian wild ryegrass and Altai wild ryegrass have a long period of growth, starting in early spring and continuing to late fall. These two grasses maintain good palatability and nutrient value through the summer and into late fall.

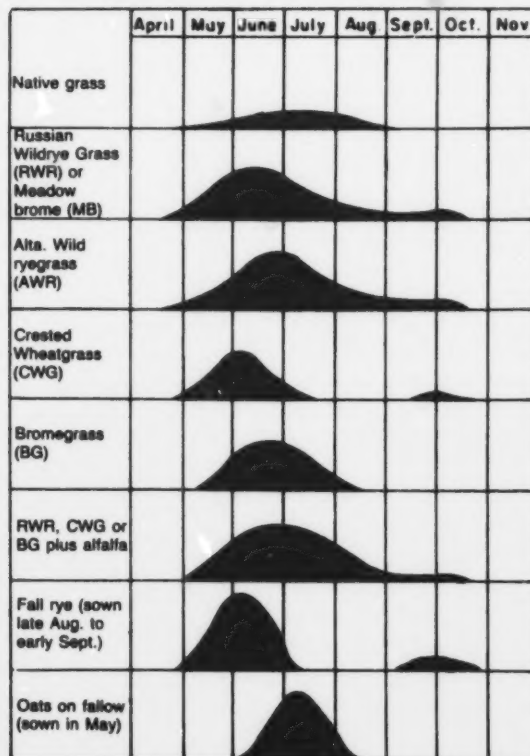
A carryover of 45% of an average season's total growth is recommended to maintain productive native pasture. On the other hand, cultivated forages can be grazed more severely. Crested wheatgrass, for example, can be grazed down to 30% carryover without adversely affecting production.

Complementary grazing then, is the use of two or more pasture types in a sequence based on growth periods of the dominant grasses in each pasture. Starting from a base of continuous grazing on native pasture, various complementary improvements can be introduced:

- provide sufficient spring grazing on cultivated (annual or perennial) forage to delay grazing of native pasture until July 15.
- establish Russian or Altai wildrye pastures to lengthen fall grazing season.
- cross-fence pastures to develop a rotational (deferred, short-duration, Savory, etc.) grazing system based on complementary use of pasture types available.

Some examples of grazing systems are shown on pages (13 and 14).

Relative yield and period of growth of native grass and seeded pastures.



Relative yield and period of growth of native grass and seeded pastures

Complementary Systems for the Black & Gray Wooded Soil Zones

Comments	Months												Ha/AUM (Ac/AUM)	Cows/ ¼ Section	Total AUM
	Fields	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.					
1. Continuous grazing on native pasture: moderate stocking rates and a 50% carry-over are essential. Uneven grazing is a problem and native grasses can be damaged by grazing in May.	NATIVE			NATIVE GRASS ONLY								1.2-1.5 (3.0-3.8)	7-9	48	
2. Complementary grazing with CWG: roughly 20% of total pasture in CWG provides good early spring grazing and improves productivity of native pasture.	CWG NATIVE		CWG*		NATIVE GRASS								0.4-0.6 (1.0-1.5) 1.1-1.4 (2.7-3.5)	8-10	63
3. Complementary grazing with RWR: the same RWR field can be used for early spring and late fall grazing, extending the grazing season to 7-8 months.	RWR NATIVE		RWR		NATIVE GRASS						RWR		0.4-0.6 (1.0-1.5) 1.0-1.3 (2.5-3.2)	8-11	71
4. Three-pasture complementary system: using CWG for spring and RWR for fall pasture can extend grazing season to 8-9 months. RWR maintains good forage quality in the fall.	CWG* NATIVE RWR		CWG		NATIVE							RWR	0.4-0.6 (1.0-1.5) 1.0-1.3 (2.5-3.2) 0.4-0.6 (1.0-1.5)	9-13	88
5. Pasture seeded entirely to tame forages and properly rotated will increase carrying capacity and extend grazing season.	CWG or RWR (& ALF) RWR RWR (& ALF)*		CWG or RWR*		RWR (& ALF)*							RWR	0.4-0.6 (1.0-1.5) 0.4-0.6 (1.0-1.5) 0.4-0.6 (1.0-1.5)	15-20	128

Abbreviations: ALF — Alfalfa, CWG — Crested Wheatgrass, RWR — Russian Wild Rye-grass,
AUM — Animal Unit Month

* The addition of alfalfa to a spring or summer pasture can increase carrying capacity a further 20 to 50%.

The Animal Unit Month (AUM) Concept

The AUM concept is very useful for planning grazing strategies. One AUM is defined as one 1000 lb. cow (with calf at foot) grazing for one month. Thus a quarter section that is rated at 48 AUM can carry 8 cows for 6 months. Alternately, the pasture can carry 12 cows for 4 months, or any other combination that works out to 48 AUM.

Other livestock are rated the following way:

1 1000 lb cow (w/calf)	1.0 AUM
1 yearling steer or heifer	.65-.75
1 bull	1.5
1 horse	1.5
5 ewes (w or w/o lambs)	1.0

For larger cows, AUM value can be adjusted upward (example: cows averaging 1200 lbs would equal 1.2 AUM).

Complementary Pasture Systems for Brown & Dark Brown Soil Zones

Comments	Months												Ha/Cow (Ac/Cow)	Cows/ ¼ Section	Total AUM
	Fields	Apr.	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.					
1. Grazing bush pastures before mid-June will reduce long-term carrying capacity.	BUSH PASTURE												2.6-6.4 (6.4-15.8)	10-25	60
2. Seeding about 20% of the area to CWG or other spring forage and fencing for rotational grazing control will extend grazing season.	CWG BUSH PASTURE			*CWG			CWG						8-1.1 (2-2.7) 2.1-4.3 (5.2-10.6)	12-22	85
3. Rejuvenating 20% of old stands and rotating stock will increase carrying capacity and extend grazing season.	CWG DEPLETED TAME PASTURE			*CWG			CWG						8-1.1 (2-2.7) 1.6-2.2 (4-5.4)	18-26	110
4. Rotational grazing and tame forages such as these will probably be the most economical of all grazing methods.	CWG & ALF BR & ALF			**CWG & ALF			**BR & ALF						8-1.1 (2-2.7) 9-1.3 (2.3-3.2) 8-1.1 (2-2.7)	26-36	150

Abbreviations: ALF — Alfalfa, CWG — Crested Wheatgrass, BR — Bromegrass or Meadow Bromegrass, AUM — Animal Unit Month

* Note actual time to start grazing in the spring should be based on forage height 10-15 cm (4-6 in) rather than any specific date.

** The addition of alfalfa to a spring or summer pasture can increase carrying capacity a further 20 to 50%.

Bloat

Bloat is a potentially lethal expansion of the stomach in ruminant animals, which can occur after they have eaten large quantities of legume forage. Legumes can create a stable foam in the rumen, which blocks the normal escape of gas.

Fear of bloat causes many producers to avoid use of forage legumes; however, most of the specific situations that cause bloat can be avoided.

- Do not turn livestock directly on to a lush, vigorously-growing legume field. Make sure the animals are already fed when they go on, and avoid putting them on in the morning, when dew increases plant moisture content.
- Seed pastures to a mixture of grasses and legumes, to reduce legume intake.
- In high-risk situations, feed bloat control products containing poloxalene.
- Consider use of non bloating legumes (sainfoin) or low-growing types (certain clovers, cicer milkvetch).

Certain breeds and strains of livestock seem to be prone to bloat. Bloat animals can be saved if prompt action is taken, in consultation with a veterinarian.

Feed Testing Service:

Sask. Feed Testing Laboratory
University of Saskatchewan
Saskatoon, Sask. S7N 0W0
tel.: 966-5620

Nitrate Poisoning

Frosted green oats can cause nitrate poisoning, as well as barley, wheat, corn, flax, sorghum and other forages and certain weeds (lamb'squarters, kochia and Russian thistle).

Plants take up nitrogen largely in the form of nitrate. Under favorable growing conditions, the plant quickly converts nitrate to non-toxic compounds. Poor growing conditions (drought or frost) can cause nitrate to accumulate. When conditions improve and the plant starts growing again, nitrates are quickly used up.

When livestock consume forage containing nitrate, their ability to absorb oxygen is inhibited. Symptoms of subacute nitrate poisoning include restlessness, frequent urination and watery eyes. Acute poisoning causes extreme weakness, blue coloration of eyes and mouth, shortness of breath, and finally death. Nitrate poisoning can be treated by prompt injection (by a veterinarian) of aqueous methylene blue.

Nitrate poisoning can be avoided by taking these precautions. Feed animals first before turning them out on lush annual pasture or cereal aftermath. Check herd frequently during initial period and consider supplementary feeding. Have stored hay (especially frozen cereal forage) analyzed by the Feed Test Laboratory. (It is a good management practice to have all forages analyzed).

Comparative Seed Size of Most Forage Crops

Crop	Approx. No. of Seeds/kg	Approx. No. of Seeds/lb.
LEGUMES		
Alfalfa	440,000	200,000
Sweet-clover	572,000	260,000
Alsike clover	1,540,000	700,000
Red clover	605,000	275,000
White clover	1,760,000	800,000
Bird's-foot trefoil	825,000	375,000
Sainfoin	66,000	30,000
Cicer milk-vetch	286,000	130,000
GRASSES		
Russian wild rye	385,000	175,000
Altai wild rye	112,000	51,000
Crested wheat grass	385,000	175,000
Northern wheat grass	340,000	155,000
Western wheat grass	242,000	110,000
Intermediate wheat grass	194,000	88,000
Pubescent wheat grass	220,000	100,000
Slender wheat grass	350,000	160,000
Streambank wheat grass	344,000	156,000
Tall wheat grass	174,000	79,000
Kentucky blue grass	4,800,000	2,182,000
Smooth brome grass	300,000	136,000
Meadow brome grass	176,000	80,000
Creeping red fescue	1,353,000	615,000
Meadow fescue	506,000	230,000
Tall fescue	500,000	227,000
Meadow foxtail	1,270,000	577,000
Creeping foxtail	1,657,000	753,000
Orchard grass	1,439,000	654,000
Timothy	2,710,000	1,232,000
Reed canary grass	1,175,000	534,000

Calculating Custom Seeding Rates

For individualized seeding rates, the following information can be used. Optimal seeding rates range from 20 seeds per square foot in dry areas (brown soils) to 45 seeds per square foot in moist areas (Parkland) or irrigated land.

Sample Calculation: straight alfalfa in high moisture area:

45 seeds/ft² X 43,560 ft² = 1,960,200 seeds/acre

alfalfa contains 200,000 seeds/pound (see table)

1,960,200/200,000 = 10 lbs. alfalfa per acre

Other forages can be calculated on the same basis. For mixtures, the same guideline can be used, i.e., the sum of all the seeds in the mix should work out to 20 to 45 seeds per square foot, depending on moisture.

Row spacing generally ranges from 24 inches in the driest soils to 6 inches in high moisture/irrigated situations. Wide row spacings encourage flowering in grasses and legumes, so row spacings for forage seed production are usually wider than for forage production.

Optimal seeding rates may be varied somewhat based on seed quality and cost, seeding conditions and end use of the crop.

References

Agriculture Canada

- Alsike Clover. Publ. 1264
- Altai Wild Ryegrass. Contribution 1983-3E
- Annual Crops for Forage in Southern Saskatchewan. Mimeo.
- Circular. Swift Current Research Station
- Annual Crops for Forage in the Alberta Parklands. Tech. Bull. 1988-1E.
- Brush Control in Western Canada. Publ. 1240.
- Creeping Red Fescue. Publ. 1122.
- Crested Wheatgrass. Publ. 1295. Contribution 1983-18E.
- Developing Bush Pastures, A Management and Economic Guide. Publ. 72/4
- Growing Corn. Publ. 1025.
- Growing and Managing Alfalfa in Canada. Publ. 1705
- Growing Russian Wild Ryegrass in Western Canada. Publ. 1607.
- Insect Pests of Legume and Grass Crops in Western Canada. Publ. 1435.
- Intermediate Wheatgrass. Contribution 1983-2E.
- Irrigated Pastures for Cattle in Western Canada. Publ. 1526.
- Management of Alfalfa for Seed Production in Southern Alberta
- Management of the Western Range. Publ. 1425.
- Managing Crested Wheatgrass Pastures. Publ. 1473.
- Pasture Management in Southwestern Saskatchewan. Mimeo.
- Circular. Swift Current Research Station
- Red Clover Production. Publ. 1614
- Reed Canarygrass. Publ. 805, 1981.
- Sainfoin for Western Canada. Publ. 1470
- Sweetclover Production in Western Canada. Publ.

Canadian Seed Growers' Association

- Pedigreed Forage Seed Production.
- Regulations and Procedures for Pedigreed Seed Production.
- Circular 6-84.

Alberta Department of Agriculture

- Alberta Agriculture Forage Manual
- Varieties of Annual Forage Crops for Alberta

Manitoba Department of Agriculture

- Field Corn in Manitoba. Publ. 428.
- How to Stack Baled Hay and Straw. Publ. 362.

Saskatchewan Agriculture

- Alfalfa Seed and Leafcutter Bee Production in Saskatchewan.
- Chemical Weed Control in Cereal, Oilseed, Pulse and Forage Crops.
- Feed Testing.
- Field Crop Insect Control.
- Forage Harvesting Methods.
- Grassed Waterways for Gully Control.
- Guide to Farm Practice in Saskatchewan.
- Kochia: Problem Weed or Opportunity Feed?
- Legume Inoculation.
- Saskatchewan Fertilizer Practices.
- Save the Soil.
- Silage.
- Soil Improvement with Legumes.
- Soil Salinity.
- Understanding Salt-Affected Soils.
- Weed Control in Corn, 1985.

Revised in 1988 by D. Gayton with assistance from: D. Belisle, B. Gopen, G. Griffin, J. Gross, N. Holt, P. Jefferson, B. King, B. Knowles, T. Lawrence, D. McCartney, L. Piggott, N. Paul, J. Romo.

The Saskatchewan Advisory Committee on Forage Crops.